

ABSTRACT OF THE DISCLOSURE

The present invention relates to an artificial neural network (ANN) representation for system dynamics models (SDMs) and its applications in model construction and policy design. It first shows that, by a special design of the mapping scheme, a given flow diagram (FD) (i.e., traditional representation) can be transformed into a corresponding model in the representation of partial recurrent networks (PRNs) that will correctly behave like the one it mimics. The present invention shows the equivalence of the two types of representations, both structurally and mathematically. With the additional representation, an automatic learning method that can assist in the construction of SDMs is proposed, which starts from an initial skeleton of a PRN (mapping from an initial FD), identifies the cause-effect relationships within the SDM by neural learning, and then converts it back to the corresponding FD. The composite approach makes model construction simpler and more systematic. Similarly, by assigning an intended behavior pattern as a set of training examples for a given SDM, it can learn a new system structure with the PRN representation; the differences between the original and new structures lead to considerations of policy design. Besides, one can also allow the learning process to restart after some period of using a model so that it has a chance to evolve and adapt to temporal changes in the environment. This touches an area that has not yet been well solved; i.e., feedback to a system might change not only its behavior but also the internal system structure since, for example, a social system is usually organic.